Box 2
DIAGNOSIS OF PRODUCTION AND FOREIGN TRADE IN THE INDUSTRIAL MANUFACTURING SECTOR

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The behavior of production and foreign trade in the country's industrial manufacturing sector was analyzed in previous editions of this report, with special emphasis on how they react to changes in the exchange rate for the dollar. It also was suggested that the recent depreciation of the peso could have a positive effect on industrial production in two ways. First, import substitution with domestic production could occur, inasmuch as imports have become more expensive and the demand for them has declined as a result. Secondly, increasing the peso income of exporting firms generates an incentive for them to increase industrial production with an eye towards more sales abroad.

However, so far this year (with data up to August), the annual figures for growth in industrial production in the various branches of the economy remain mixed. According to the Monthly Manufacturing Survey, branches such as coking, oil refining and fuel blending, the production of beverages and the manufacture of processed metal products grew significantly, while production in sectors such as leather tanning and retanning, and the manufacture of (other types of) transport equipment experienced major setbacks (Table B2.1). In fact, growth in non-refining industrial production by August 2016 came to a modest 1.4%.

The same table also shows the annual changes in exports and imports in dollars, in current pesos and in constant or real pesos. The latter were constructed by deflating the nominal values in pesos for each branch of industry, using the export and import producer price indexes (PPIs)[1] prepared by DANE. This exercise allows for a better estimate of the real variations in the trade series than the one obtained if the changes in volumes sold are used, since this last approach encompasses a broad mix of products, even if the changes are calculated within the same branch of the industry.

An initial look at the figures in Table B2.1 shows the changes in exports and imports in current pesos exceed the variation in the dollar series. This is due to depreciation of the exchange rate (which was more pronounced as of the second half of 2015).[2] In fact, for some sectors, one sees that even though exports in dollars fell during this period, exports in pesos grew. Bakery products are an example.

Furthermore, a significant amount of the growth in exports in current pesos coincides with the rise in real industrial production (see the gray shaded area in Table B2.1). However, when examining the variation in real terms, one does not see a systematic relationship between production growth and positive variations in external sales. In fact, this is the case with only four items, which account for 18.5% of industrial production[3] (the manufacture of leather goods; coking, oil refining and fuel blending; the manufacture of glass and products thereof; and the manufacture of processed metal products).

The information in Table B2.1 also shows industrial production increased and imports in real terms decreased (shaded in yellow) in 16 of the 39 branches analyzed. This would suggest possible import substitution in these sectors, which account for 31.4% of industrial production. The production of certain foodstuffs, the manufacture of leather goods, the production of chemical products and industries producing metallic products stand out, among others. Industry as a whole, excluding

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1 The PPI export/import series are not available for three branches in the case of exports (printing activities, the manufacture of auto bodies for motor vehicles, trailers and the manufacture of other types of transport equipment), and one branch in the case of imports (printing activities). As a result, the PPI for produced and consumed goods was used as the deflator of the nominal trade variables.

2 The average exchange rate depreciated by nearly 20% between January and August 2016 with respect to the same period in 2015.

3 This is according to the weighted values in August 2016, based on the DANE Industrial Production Index.

Table B2.1
Annual Year-to-date Growth in Industrial Manufacturing Output, Exports and Imports. January-August 2016

Branches	Industrial Production in Real Pesos (Percentage)	Exports (Percentage)			Imports (Percentage)		
		Value in dollars	Value in current pesos	Value in real pesos	Value in dollars	Value in current pesos	Value in real pesos
Processing and preserving of meat, fish, crustaceans and mollusks	2.9	-11.2	6.4	-4.1	-13.6	3.7	-8.6
Manufacture of oils and fats of vegetable and animal origin	-4.4	13.2	33.2	6.8	-1.8	16.1	6.7
Manufacture of dairy products	1.6	-62.3	-57.9	-65.5	57.6	93.0	64.5
Manufacture of milled grain products, starches and derivatives thereof	7.7	-25.6	-11.2	-23.4	-13.1	4.9	-0.6
Coffee processing	-1.6	-19.3	-3.3	-10.1	-22.7	-6.3	-23.2
Preparation of sugar and panela	-10.1	-33.1	-20.3	-40.8	278.4	357.9	189.0
Manufacture of bakery products	1.7	-4.6	14.6	-2.2	-20.1	-4.5	-13.7
Manufacture of cocoa, chocolate and confectionery products	-7.8	17.0	44.8	22.8	8.4	28.6	16.7
Manufacture of other food products n.c.p.	2.4	-7.6	10.6	-6.1	1.0	20.1	4.7
Manufacture of processed foods for animals	-0.1	19.8	42.5	29.6	-0.7	19.3	9.2
Manufacture of beverages	11.6	-26.6	-13.5	-15.0	41.5	66.0	42.3
Spinning, weaving and finishing of textile products	-1.7	-28.7	-15.3	-28.1	-0.6	17.2	5.8
Manufacture of clothing and wearing apparel	-2.1	-17.3	-1.6	-14.6	-26.1	-11.8	-19.4
Leather tanning and retanning; retanning and dyeing hides	-19.6	-39.2	-26.2	-24.3	7.4	26.5	13.1
Manufacture of leather travel articles, handbags and the like	7.2	-9.5	8.0	0.1	-19.7	-4.2	-14.9
Manufacture of footwear	7.5	-15.9	0.7	-8.0	-17.9	-2.4	-7.4
Transformation of wood and products thereof	-0.5	-2.4	16.8	2.6	-13.3	4.1	-14.3
Manufacture of paper, cardboard and products thereof	-1.2	-32.3	-19.0	-30.9	-11.1	6.2	-8.8
Printing activities	4.3	-12.9	5.4	-26.8	3.1	24.0	-13.9
Coking, oil refining, and blending of fuels	20.8	24.6	48.1	51.9	-23.9	-9.2	3.4
Manufacture of basic chemical substances and products thereof	-4.4	-13.8	2.9	-9.3	-15.6	0.4	-8.1
Manufacture of other chemical products	1.8	-11.4	4.3	-9.5	-12.6	4.2	-6.2
Manufacture of soaps and detergents, perfumes and toiletries	2.5	-21.0	-5.7	-15.0	-16.0	0.2	-3.8
Manufacture of pharmaceuticals and medicinal chemical substances	2.5	-9.7	7.9	-5.8	-10.9	6.0	-0.9
Manufacture of rubber products	-7.0	-45.6	-35.5	-33.4	-16.9	-0.4	-10.4
Manufacture of plastic products	-0.5	-11.9	5.0	-11.1	-14.8	1.6	-9.3
Manufacture of glass and glass products	8.3	2.7	22.7	14.3	-18.7	-3.0	-14.1
Manufacture of non-metallic mineral products n.c.p.	-3.1	-11.2	5.7	-3.7	-4.7	13.6	-1.6
Basic iron and steel industries	2.3	-31.9	-18.9	-8.9	-34.2	-21.1	-25.4
Basic precious and non-ferrous metal industries	8.4	-2.5	15.3	-7.0	-18.7	-2.4	-9.3
Manufacture of products made of metal	10.6	0.4	19.5	3.9	-21.3	-5.6	-15.5

Table B2.1 (Continued)
Annual Year-to-date Growth in Industrial Manufacturing Output, Exports and Imports. January-August 2016

Branches	Industrial Production in Real Pesos (Percentage)	Exports (Percentage)			Imports (Percentage)		
		Value in dollars	Value in current pesos	Value in real pesos	Value in dollars	Value in current pesos	Value in real pesos
Manufacture of electrical appliances and equipment	-7.0	-8.4	9.4	-8.4	-22.2	-7.2	-18.5
Manufacture of machinery and equipment n.c.p.	-0.9	9.0	30.9	10.9	-23.7	-9.0	-22.5
Manufacture of motor vehicles and their engines	2.0	-9.0	7.6	-5.0	-20.7	-5.7	-13.4
Manufacture of bodywork for motor vehicles, automobiles and trailers	-11.7	11.1	37.9	32.1	-27.9	-13.5	-28.1
Manufacture of parts, pieces (auto parts) and accessories (luxury) for vehicles	-9.8	-33.9	-21.1	-32.3	-3.3	15.3	-2.7
Manufacture of other types of transport equipment	-15.7	38.8	60.7	36.8	-63.0	-54.9	-60.8
Manufacture of furniture, mattresses and mattress bases	4.6	-9.1	8.8	-7.3	-20.8	-5.4	-14.1
Other manufacturing industries	0.1	-7.2	9.9	-3.9	-13.6	2.1	-7.5
Total non-refining industry	**1.4**	**-12.9**	**3.9**	**-8.6**	**-21.2**	**-5.9**	**-15.8**
Total industry	**4.5**	**-8.8**	**8.7**	**-1.3**	**-21.5**	**-6.2**	**-13.7**

n.c.p .: not classified previously
Note: In the case of exports, gray shading indicates the branches where there was growth in industrial production and exports increased. In the case of imports, the yellow shading denotes the branches where industrial production grew and imports declined.
Source: DANE; Calculations of the Bank of the Republic

refining, experienced moderate growth in real production, and real imports declined.

On the other hand, Graph B2.1 shows dispersion diagrams of trade versus production, both in real terms, obtained from the data in Table B2.1. The diagrams do not show a clear relationship between the values for growth in the trade variables and those for industrial production. Although, in the case of exports, it is evident the increase in real exports could be correlated positively with the change in actual production. However, in estimating the correlations for these variables, none of them were found to be statistically significant (at 10%), even though the increase in real exports and the growth in industrial production have a positive correlation, and the growth in real imports and the increase in industrial production have a negative correlation.

Following this line of analysis, an additional cross-correlation exercise compatible with previous ones was done, using monthly data, to estimate the correlation between the real industrial production index and real exports and imports between January 2015 and August 2016. This is a period of sharp peso depreciation and is compatible with previous exercises (Table B2.2).

In thirteen branches of industry where real production increased (according to Table B2.1), a positive correlation was found (significant to 10%) between real exports and industrial production (blue shading). This was calculated with monthly data from each branch of industry and shows the increase in production in these branches is associated, to some extent, with the rise in exports. [4] Branches such as coking, petroleum refining and fuel blending, and the manufacture of footwear stand out, among others, and account for 38.4% of domestic production.

As for imports, in ten branches of industry where production increased (they represent 21.3%), a significant negative correlation of 10% was found between foreign purchases of goods and industrial production (yellow shading). This helps to reinforce the hypothesis of import substitution in these branches of industry. Once again, the manufacture of foodstuffs, leather goods,

4 A positive correlation could also be observed in the case where both series (industrial production and exports) show declines that are systematically linked. Therefore, these calculations are only an indication of an increase in production related to an increase in exports. The same is true of imports, since negative correlations could also occur when imports increase and industrial output drops (accordingly, a negative correlation is not an unequivocal sign of import substitution).

chemical products, and industries producing metallic goods are the cases that stand out.[5]

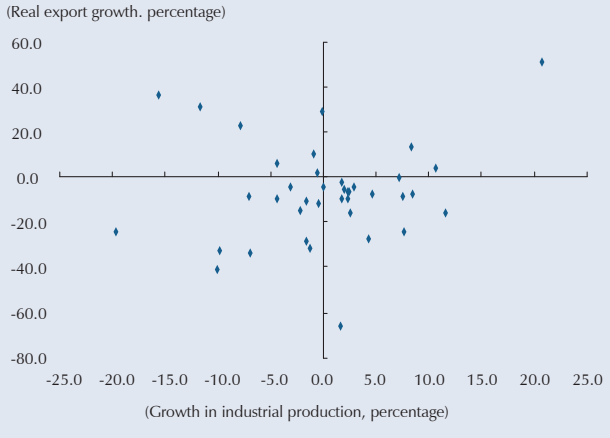
On the other hand, this same exercise for the aggregate of the manufacturing industry (total industry and total industry without refining) indicates, in real terms, that industrial production grows, exports also grow, and imports decline. However, the disaggregated analysis of cross-correlations by branches of industry shows depreciation has no such effect on the momentum in production and international trade for a significant number of them.

In summary, it is possible to say the exercises presented in this section suggest import substitution has occurred in certain sectors of Colombian manufacturing, although they do not allow us to conclude this has happened in a generalized way. At the same time, there is evidence that depreciation against the dollar in 2015 has boosted production for export in some branches of Colombian industry. Monitoring these exercises in the future will allow us to follow up on the performance of production and international trade, and on how they relate to changes in the exchange rate.

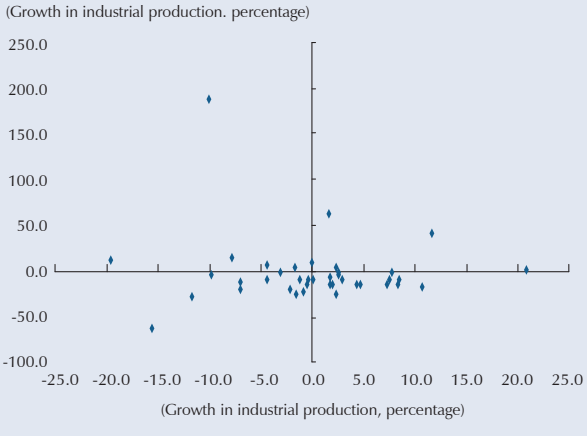
5 These exercises do not consider the order in which these processes can occur (increase in exports / decline in imports and growth of industrial production). For example, a negative correlation between industrial production and imports, regardless of the order in which the movements occur in the series in question, is considered as evidence of import substitution. A more rigorous analysis would consider the causality between such movements.

Graph B2.1
Dispersion Diagrams for Trade by Industry Branches versus Production in Real Terms
(Annual changes, accumulated figure for January-August 2016)

A. Exports



B. Imports



Source: DANE; calculations by Banco de la República.

Table B2.2
Cross-correlations between the Real Industrial Production Index versus Real Exports and Imports,
January 2015 through August 2016

Branches	Exports vs. Industrial Production	Imports vs. Industrial Production
Processing and preserving of meat, fish, crustaceans and mollusks	0.63 (0) a/	-0.50 (-6) a/
Manufacture of oils and fats of vegetable and animal origin	0.31 (4)	-0.43 (-1) a/
Manufacture of dairy products	0.37 (0)	-0.48 (1) a/
Manufacture of milled grain products, starches and derivatives thereof	-0.35 (-5)	-0.54 (0) a/
Coffee processing	0.43 (-2) a/	0.40 (5) a/
Preparation of sugar and panela	0.66 (-1) a/	- 0.47 (-2) a/
Manufacture of bakery products	0.51 (-5) a/	-0.28 (-2)a/
Manufacture of cocoa, chocolate and confectionery products	0.31 (6)	-0.35 (-3)a/

Table B2.2 (Continued)
Cross-correlations between the Real Industrial Production Index versus Real Exports and Imports, January 2015 through August 2016

Branches	Exports vs. Industrial Production	Imports vs. Industrial Production
Manufacture of other food products n.c.p.	0.39 (0) a/	-0.44 (6) a/
Processing of prepared animal feed	-0.56 (-1) a/	0.37 (-6)
Manufacture of beverages	-0.54 (-1) a/	0.77 (0) a/
Spinning, weaving and finishing textile products	0.32 (0)	0.56 (0) a/
Manufacture of clothing and wearing apparel	0.50 (0) a/	0.44 (0) a/
Leather tanning and retanning; retanning and dyeing hides	0.66 (1) a/	-0.30 (-5) a/
Manufacture of leather travel goods, handbags and the like	0.63 (0) a/	-0.52 (-1) a/
Manufacture of footwear	0.68 (0) a/	0.73 (0) a/
Transformation of wood and products thereof	0.29 (-2)	0.45 (0) a/
Manufacture of paper, cardboard and product thereof	0.44 (4) a/	0.67 (0) a/
Printing activities	0.34 (5)	0.57 (3) a/
Coking, oil refining, and blending of fuels	0.80 (0) a/	0.37 (6)
Manufacture of basic chemical substances and products thereof	0.51 (0) a/	0.56 (0) a/
Manufacture of other chemical products	0.61 (-2) a/	0.70 (0) a/
Manufacture of soaps and detergents, perfumes and toiletries	0.40 (0) a/	-0.46 (4) a/
Manufacture of pharmaceuticals and medicinal chemical substances	0.30 (0)	0.45 (0) a/
Manufacture of rubber products	0.68 (-1) a/	0.68 (-5) a/
Manufacture of plastic products	0.49 (0) a/	0.67 (0) a/
Manufacture of glass and glass products	0.43 (0) a/	-0.49 (-1) a/
Manufacture of non-metallic mineral products n.c.p.	-0.52 (-3) a/	0.54 (0) a/
Basic iron and steel industries	-0.62 (1) a/	-0.28 (-6) a/
Basic precious and non-ferrous metal industries	0.48 (2) a/	-0.44 (-2) a/
Manufacture of products made of metal	0.60 (0) a/	0.40 (-1) a/
Manufacture of electrical appliances and equipment	0.69 (0) a/	0.55 (0) a/
Manufacture of machinery and equipment n.c.p.	-0.30 (2) a/	-0.49 (6) a/
Manufacture of motor vehicles and their engines	0.58 (-5) a/	0.56 (0) a/
Manufacture of bodies for motor vehicles, automobiles and trailers	0.47 (0) a/	0.35 (0)
Manufacture of vehicle parts, pieces (auto parts) and accessories (luxury)	0.66 (0) a/	0.41 (0) a/
Manufacture of other types of transport equipment	-0.52 (5) a/	0.38 (0) a/
Manufacture of furniture, mattresses and mattress bases	0.62 (0) a/	-0.50 (-5) a/
Other manufacturing industries	0.45 (0) a/	0.50 (0) a/
Total non-refining industry	**0.69 (0) a/**	**-0.56 (-6) a/**
Total industry	**0.67 (0) a/**	**-0.60 (-6) a/**

n.c.p.: not classified previously
a / Significant at 10%.
Note: In the case of exports, the gray shading denotes the branches where there is growth in industrial production and a significant positive correlation between exports and industrial production. In the case of imports, the yellow shading indicates the branches were there is growth in industrial production and a significant negative correlation between imports and industrial production.
The real industrial production series for total non-refining industry was constructed by discounting coking, oil refining and blending of fuels from the series for total industry, according to their respective weight at August 2016.
The numbers in brackets indicate the lag in the industrial production pertaining to the correlation presented (the one with the highest value in absolute terms).
Source: DANE; calculations by Banco de la República